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A Study of the Apical Growth of the Prothallium of Ferns with Reference to their Relationships.

By Douglas H. Campbell.

(Plate CXV.)

In January of last year I published in the Botanical Gazette* a paper on the affinities of the Filicineæ suggested by a similar one by Bower† in the Annals of Botany, the object of my paper being to defend the older theory of the origin of the ferns from the Hepaticæ, as opposed to the later theory of Bower‡ and others that the ancestral forms of the pteridophytes were alga-like forms similar to the filamentous prothallium of certain Hymenophyllaceæ which are regarded as the most primitive of living Filicineæ.

Having been engaged for some time past in the further study of this problem, a number of facts have been collected which may serve to throw some further light on this most interesting question.

As is well known, the prothallium of most ferns bears a most striking resemblance to certain thallose liverworts,—indeed, so striking is the resemblance that sometimes a miscroscopic examination is necessary to distinguish them, and when the prothallia remain unfertilized they may reach a size considerably surpassing many of the smaller liverworts.§

In its earlier stages the young fern-prothallium usually grows

* Campbell—On the affinities of the Filicineæ. Bot. Gaz. Jan. '90.

† Bower—The Comparative Examination of the Meristems of Ferns as a Phytogenetic Study. Annals of Botany.

‡ Bower—l. c. p. 386.

§ Goebel—"Outlines." p. 199.

by means of a single two-sided special cell, which is often established very early (See Fig. 1-a), and may persist until the prothallium has reached a considerable size. This cell has two sets of segments cut off from its sides, by walls which are parallel to the latter. This regular succession of segments is usually conspicuous and the limits of the individual segments are often recognizable for a long time (Fig. 2). Sooner or later the apical cell is divided by a wall at right angles to the axis of the prothallium into a marginal cell, four-sided when seen from above; and an inner triangular cell (Fig. 6). The former of these next divides in most cases by a longitudinal wall into two equal cells, but in some cases observed (in *Osmunda cinnamomea*) the single four-sided cell may persist for a time as a single apical cell. (Figs. 4, 5).

All of these points are readily made out from surface views of the prothallium, and with the exception of the last mentioned, have been repeatedly observed and recorded by numerous writers; but the fact that in the later stages of the apical cell (or cells), there is a perfect regularity in the succession of segments cut off, seems to have entirely escaped the attention of these investigators. Kny* it is true, figures, in the main correctly, a longitudinal section of the prothallium of *Osmunda regalis*, showing the apical cell and its younger segments; but makes no reference to having detected any regularity in the arrangement of the cells, simply stating that walls are formed parallel to the surface of the prothallium, thus giving rise to the thickened midrib characteristic of the prothallium of the Osmundaceæ.

When we compare the process of growth here briefly outlined with that of the thallose liverworts, we cannot but be struck with the remarkable resemblances—nay, identity in many cases—of the two.

The liverworts have been repeatedly and carefully studied, especially by Leitgeb, and in his magnificent work† upon them, we have ample means for comparing their development with that of the fern-prothallia. Recently also, Kny‡ has published an

* Kny—Entwickelung des Vorkeimes von *Osmunda regalis*. Pl. II. fig. 2.

† Leitgeb—Untersuchungen ueber die Lebermoose. 1874–1881.

‡ Kny—Bau und Entwickelung von *Marchantia polymorpha*, 1890.

account of the structure and development of *Marchantia* which shows also some remarkable resemblances to the growth of the fern-prothallium. So often, indeed, in comparing the liverworts with the fern-prothallium, do we meet with the same structure and method of growth, that such extraordinary correspondence of structure, without a corresponding relationship, seems impossible.

Of the liverworts known at present, the thallose Jungermanniaceæ and certain Anthoceroteæ approach most nearly in structure in their mature condition, to the fern-prothallium. In the former, according to Leitgeb* there is always a single apical cell so that these plants show throughout their life a condition which is usually but transitory in the fern-prothallium. In such forms as *Metzgeria* too, the structure of the thallus is essentially the same as the prothallium of the Osmundaceæ.

In *Metzgeria* and *Aneura*† as well as other related genera, the apical-cell is of the two-sided form and the succession of segments same as in the fern-prothallium. In *Pellia*‡ it corresponds closely in form to that shown in Fig. 4, 5, and probably represents a higher degree of development.

In the Anthoceroteæ§ there seems to be at the growing points of the full-grown thallus a row of similar cells, much as in the full-grown fern-prothallium. Whether this is preceded by a single apical cell in the young plant is uncertain, as our knowledge of the germination of the spores is limited to that of the genus *Anthoceros*,‖ and this point does not appear to have received the attention it deserves.

The Marchantiaceæ** and Ricciaceæ,†† correspond closely in the structure and growth of the thallus, and all, so far as is known, have at the growing point a row of similar cells, cutting off two sets of segments above and below. The germination of the spores in the latter group is known only in *Riccia glauca*, and according to Leitgeb‡‡ is entirely similar to that of the

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* l. c. Vol. III. p. 6.
† Leitgeb, l. c. Vol. III. p. 40. Pl. I. II.
‡ Leitgeb, l. c. Vol. III. p. 7, 53. Pl. III.
§ Lietgeb, l. c. Vol. V. p. 13. pl. I.
‖ l. c. p. 29.
** Leitgeb, l. c. Vol. VI. p. 2.
†† l. c. Vol. II. p. 16. Pl. IX.
‡‡ l. c. p. 23.

Marchantiaceæ investigated. Unfortunately I have been unable to find an account of the details. Of the Marchantiaceæ *Marchantia* has been the subject of a recent work by Kny already cited. This latter is especially interesting, as it shows that in its development the young thallus follows step by step, precisely the same course described in the young fern-prothallium*. First the protonemal filament; next oblique walls cutting off a *single two-sided apical cell;* this is then divided by a transverse wall, and the inter cell, by longitudinal walls becomes transformed into the row of marginal cells that characterizes the growing point of the older thallus.

Owing to their extreme delicacy, it is almost impossible to make satisfactory longitudinal sections through fern-prothallia without imbedding them. It is no doubt for this reason that no satisfactory account of the cell-division in the apex, subsequent to the formation of the thickening back of it, has been given. It is possible, however to imbed them in paraffine and it is then a simple matter to make very thin sections which show every detail of structure with perfect clearness. It is then plainly evident that the divisions are perfectly regular and referable to a type found among the liverworts.

To prepare the specimens for imbedding 1 per cent. chromic acid was used to fix them, and after dehydrating and passing gradually into turpentine, they were placed for several hours in melted paraffine. As a stain, Bismarck brown was the most satisfactory. A solution in 70 per cent. alcohol was used, staining on the slide. In this way the young cell-walls are strongly colored and the preparations show every detail with the utmost sharpness.

SPECIAL INVESTIGATIONS.

Sections were made of the prothallia of *Onoclea sensibilis* and *O. Struthiopteris*, as well as a number of undertermined Polypodiaceæ, and of *Osmunda cinnamomea*. In all of these a strong resemblance was observed.

In the larger prothallia of the Polypodiaceæ, so far as observed, the growing point consists of a row of several cells, (Fig. 3, a, a^{I}, a^{II}), each one nearly four-sided as seen in sections parallel with the surface of the prothallium. These divide oc-

* Kny, l. c. pp. 387–389. Fig. xc.

casionally by longitudinal walls and thus add to the number of marginal cells of the prothallium; but the further growth of the secondary marginal cells is limited, while that of the apical cells is unlimited. From the bases of the apical cells segments are also cut off, which contribute to the formation of the cushion which bears the archegonia.

Vertical sections of the apical cells are almost perfectly semi-circular in form (Figs. 7, 8, a), and comparing this with the surface view, or sections parallel to the surface, we see that these cells are shaped like a flat half-disk. As compared with the other cells they are large, and an examination of the segmentation shows that the divisions occur with great regularity. The segments are cut off by a wall parallel with the inner wall of the apical cell, and reach from the upper surface to the lower one of the prothallium. (Figs. 7, 8). The segment is next divided by a wall at right-angles to the first formed, into two cells, of which the lower one (the upper one in the figure), is slightly larger, and divides more actively than the upper, so that the thickening on the lower side of the prothallium is more marked than on the upper, and results in the formation of the projecting cushion of tissue upon which are borne the archegonia. These seem to bear a definite relation to the segments. After the first division in the young segment, walls are formed in each semi-segment perpendicular to the surface of the prothallium, thus dividing the segment into four cells, two of which are dorsal and two ventral. One of the latter forms at once the mother-cell of the young archegonium. (Fig. 7 ar.).

In *Osmunda* observations were limited to young prothallia that had not yet formed archegonia, but as in this genus there is a thickened midrib traversing the whole prothallium almost from the first, it was to be expected that the method of growth would not deviate very much from that of the Polypodiaceæ. It is not at all infrequent to find in *Osmunda* (*O. cinnamomea*, and *O. Claytoniana*) that the two-sided apical cell of the young prothallium gives place to a single cell from which three sets of segments are cut off—two lateral and one basal. (Figs. 4, 5). In the cases observed this cell was considerably larger than the individual cells of the apex of the other fern-prothallia studied.

The apical cells are longer than those of the Polypodiaceæ, but closely resemble them. (Fig. 9, 10). The segments are cut off from the base in the same way, and the first wall in the segment also divides it into two nearly equal cells, dorsal and ventral. The subsequent divisions, at least in the younger prothallia, are less regular and there is a preponderance of horizontal walls. (Figs. 9, 10). The difference in the rapidity of cell-division in the dorsal and ventral segments is not noticeable. How this may be in the older prothallia, and what the relation of the archegonia to the segments is, I cannot yet state, but hope soon to have an opportunity of examining this point carefully.

When we compare the longitudinal sections of the prothallia with those of the liverworts, we find that most of the latter differ in one marked respect—viz: that two sets of segments are cut off from each apical cell (when seen in vertical section), a dorsal and a ventral one. This seems to be the case in all Marchantiaceæ* and Ricciaceæ†, and in *Anthoceros*‡; but in *Dendroceros*§, a near relative of the latter, we meet with exactly the same form as in the ferns (Fig. 11); and the single apical cell of *Pellia epiphylla*,‖ according to Leitgeb's account is also of the same type, although the nearly related *P. calycina*¶ has an apical cell closely resembling in its method of growth the individual apical cells of the Marchantiaceæ, and according to Hofmeister°, *P. epiphylla* in its earlier stages has the apical cell of the same form, so that the two types must be regarded as closely related, and possibly interchangeable. It is by no means unlikely that further investigation will show both types in the ferns.

Finally, the independent vegetative existence of the fern-prothallia, and the power of multiplication by branching are characters which they have in common with the liverworts, and this is especially marked in the Osmundaceæ, Gleicheniaceæ and Marattiaceæ, just those groups which in other respects ap-

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* l. c.

† l. c.

‡ l. c.

§ Leitgeb, l. c. Vol. V. p. 30. Pl. II.

‖ l. c. Vol. III. p. 6. 53.

¶ l. c. Vol. III. p. 7. 53.

° Hofmeister, The Higher Cryptogamia p. 23. Pl. IV.

proach most nearly the liverworts. In the two former a truly dichotomous branching, apparently entirely similar to that in the thallose liverworts, has been recorded by Goebel* and Jonkman.†

CONCLUSIONS.

From a consideration of the facts presented above, it seems that we are justified in assuming a direct relationship between the Filicineæ and the Hepaticæ. The close correspondence in the development of the two groups, as well as the structure of the thallus in the simpler liverworts, indicates that the two groups have had a common origin, and that the Filicineæ branched off from the liverworts at a comparatively late stage. Probably originating from filamentous green algæ (or possibly flattened forms like *Coleochæte*), the next stage was a delicate heart-shaped form with two-sided apical cell, as in the young fern-prothallium and such liverworts as *Metzgeria* and *Aneura*. A thickened midrib was probably early developed, and in the more differentiated forms the whole thallus became several cells in thickness and in the Marchantiaceæ especially, of considerable complexity.

It is not my purpose to speak of the affinities of the different groups of liverworts here, as that has already been ably discussed by Leitgeb‡. It may, however, be well to consider briefly the relative positions of the ferns, as indicated by a comparison with the liverworts. Of the forms that have been investigated, the prothallia of Osmundaceæ§, and Marattiaceæ,‖ resemble most nearly such liverworts as *Dendroceros* and *Pellia*, and are probably the most primitive. The Gleicheniaceæ,° resemble the Osmundaceæ, in many respects and are in certain ways a connecting link between them and the Polypodiaceæ, with which the Schizæaceæ closely agree. The Polypodiaceæ, with the Cyatheaceæ, form the end of the homosporous series. The Hymenophyllaceæ seem to be degenerate forms, and our present knowledge would indicate that they branched off pretty low down—possibly between the Osmundaceæ and Schizæaceæ.

* Goebel, *Gymnogramme leptophylla*, etc. Bot. Zeit. 1877.

† Jonkman, La Generation sexuée des Marattiaceés, p. 208. fig. 57.

‡ l. c. Vol. VI. pp. 49–53.

§ Kny, l. c. Luerssen (Schenck's Handbuch p. 171.)

‖ Jonkman, l. c.

° Rauwenhoff, La Generation sexuée des Gleichéniacées.

Our ignorance of the prothallium of the Ophioglosseæ makes it impossible to determine positively their position, but as stated in a previous paper*, there is strong ground for regarding them as the most primitive of all the Filicineæ.

The greatest difficulty, it seems to me, in establishing a direct connection between the liverworts and ferns, is in the different character of the archegonium, and the spermatozoids. The former is very constant throughout all investigated liverworts and differs in some important features from the same organ in the ferns. The spermatozoids too, are different in the two groups, being uniformly bi-ciliate in the liverworts, and multi-ciliate in the ferns. This latter difference I regard as of great importance, and it is much to be hoped that a thorough investigation of this point in the liverworts will be made, to see whether there are forms that deviate from the ordinary biciliate type.

It is by no means impossible that a careful examination of the hitherto unexplored regions of our country, especially the swamps of the Southern States, may bring to light forms which will help to solve the problem of the origin of the Pteridophytes, one of the most important questions, certainly, in systematic botany.

EXPLANATION OF FIGURES.

In all the figures the apical cells are marked a.

Fig. 1. Two very young prothallia of *Osmunda Claytoniana* × 150. Sp-Spore membrane.

Fig. 2. Apex of an older prothallium of the same. The limits of the younger segments indicated by heavier lines. × 150.

Fig. 3. Section of an older prothallium of an undetermined fern (Polypodiaceæ) a, a^{I}, a^{II}. the three apical cells × 300. Section parallel with the surface.

Figs. 4, 5. Two sections parallel to the surface, of prothallia of *Osmunda cinnamomea* with single four-sided apical cell. × 300.

Fig. 6. Surface-view of a prothallium of the same species, showing the transition from the triangular to the four-sided apical cell. × 150.

Figs. 7, 8. Vertical longitudinal section of the prothallium of *Onoclea Struthiopteris*, ar. Young archegonia. × 300.

Fig. 9. A similar section of *Osmunda cinnamomea;* the younger segments are numbered. × 150.

Fig. 10. Apex of a similar section, with the youngest segment still undivided. x 300.

Fig. 11. A similar section of *Dendroceros Breutelii* (after Leitgeb). × 350.

Figs. 1, 2, and 6 are from living specimens ; the others fixed with chromic-acid, and sectioned with the microtome.

* Campbell, l. c. p. 3.

Influence of Moisture upon Dehiscent Fruits.

By B. D. HALSTED and D. G. FAIRCHILD.

(Plate CXVI).

The changes wrought by moisture and dryness upon the dehiscent fruits doubtless assist in the dispersion of seeds in more cases than at first one is willing to grant. A number of the ordinary fruits have been experimented upon by artificially alternating a moist and dry condition, and the results are abbreviated in the following paper.

In experimenting with the fruits it was found necessary to immerse them in a vessel of water in order to get the most marked results, although evident signs of movement were observed when only a moist chamber was used. The dry conditions were generally supplied by the bright sunlight or in case this was absent, by the use of an oil stove.

In the majority of cases examined it will be noted that the hygroscopic movement is much more rapid upon the absorption of water than upon its evaporation from the fruit; but whether there is any advantage in this to the plant, may be a question.

The capsules of *Campanula Americana*, as noticed by Gray in contradistinction to *C. rapunculoides*, have their valves situated near the top, and in dry weather the flaps curl outward and upward, thus allowing free access to the winds which whistle through the openings and whirl out the light, flat seeds. These flaps uncurl and close in from ten to thirteen minutes when placed in water, but require a much longer time to open when placed in warm dry air—the exact time was not noted, but at least fifty minutes are required (Figs. 1-2).

The hard horn-like capsules of *Veronica Virginica* (Figs 3, 4, 5), are examples of a large class of dehiscent fruits, which open and close quite rapidly; that is, fifteen to twenty minutes in closing, and an hour or more in opening. A few examined belonging to this class, are *Syringa vulgaris*, (Figs. 6, 7, 8), *Steironema longifolium*, (Figs. 9-10), and *Viola palmata* var. *cucullata*.

The various species of Viola* as is well known, eject their

* For an exhaustive account of the minute structure of these opening valves of *Viola*, consult F. Hilderbrand's "Die Schleuderfrüchte und ihr im anatomischen Bau begrundeter Mechanismus. Pringsheim's Jahrbücher für Wissenschaftlichen Botanik, 1873-4, VOL. ix, pp. 235-276, taf. 1-3.

seeds by the lateral pressure which the valves exert as they fold lengthwise, but in the case of *Claytonia Virginica*, a much more complicated method of expulsion seems to be necessary (Figs. 11-15). The round, flat seeds, six in number, are arranged systematically in the capsule, and as the valves curl inwardly and press against them, the uppermost one (*a*, Fig. 13), is expelled as soon as the pressure becomes great enough. After the expulsion of the first seed, those remaining are arranged again, "loaded" for a second bombardment, and the seed *b* is shot out. In this way the entire number is expelled from the capsule, the last one by the pressure from the sides of the valves. If ripe specimens of this plant be placed in a dry room on sheets of paper, the rattle of the bombardment can be distinctly heard and the floor will be strewn for several feet with the shining seeds. Singular as it may seem in a case of this kind, where so much force is displayed, moisture seems to have little effect upon the capsules when once dried—perhaps because their office to the plant is performed when the seeds are thrown.

Hybiscus Syriacus, (Figs. 16, 17), has membranaceous capsules, which are retained upon the plant long after the seeds have been blown away, and the wide and rapid variations in the position of the valves make it a most interesting case; in fact, so pronounced are these changes that after a sharp rain the whole aspect of the plant is notably altered. These capsules are representative of a large class of membranaceous seed vessels, of which *Hypericum Ascyron*, (Figs. 18, 19), and *Dictamnus Fraxinella* (Figs. 33, 34), furnish examples. These capsules close when placed in water, in from five to fifteen minutes, varying with the species and maturity of the pods.

The long, soft pods of the *Asclepiads*, if examined upon a rainy day, will all be found closed or nearly so. The movement, although not rapid is quite marked, on account of the large size of the pods.

From its peculiar curled pods *Cassia Chamæcrista*, (Figs. 20, 21), might be expected to show decided hygroscopic movements; if these open or half-open pods are placed in water, they close in five or six minutes. Although exhibiting this rapid

hygroscopic movement, the pods possess no explosive power, as in the case of members of the genus *Phaseolus*.

The awns of many grasses, notably those of the *Stipas* and *Andropogons*, twist and untwist with changes of moisture, but those of *Hordeum jubatum*, (Figs. 22, 23), show very marked movements pointing towards the performance of quite a different office. While the movements of the awns of the Andropogons probably facilitate the entrance of the seed into the ground, those of the "Squirrel-tail" simply serve to separate joint from joint of the dry spike, and aid in their transportation from place to place, like a tumble weed. The movement is simply a lateral straightening or backward curving of the awns, which, wedge-like, raises the spikelet from among those below. Moisture has the effect of quickly reversing the process.

Similar to the last are the movements made by the pappus of numerous species of Compositæ. A sprig of *Solidago Canadensis*, some days past blooming, was placed among others in a glass of water and in five minutes the involucres, which were open as at Fig. 24, had closed in upon the achenia and pappi so completely as to make it almost a matter of doubt if the sprig was the same (Fig. 25). Upon exposure to the dry atmosphere for an hour or so, the involucres opened, and the achenia were soon seen to separate from the receptacle and mount upon each other by the force of the expanding pappus.

The heads of *Brunella vulgaris* are susceptible in a high degree to the changes of moisture. In dry weather the calices with their short pedicels stand closely appressed to the main stem, (Fig. 26), while in wet weather, they bend outward and even downward, (Fig. 27), giving the head a loose, bushy appearance quite different from its aspect in a dry atmosphere.

Upon examining the heads of the common Bergamot (*Monarda fistulosa*), it was found that the dry, tubular calices, which are arranged on branches or arms radiating from the center, are almost always split open at their bases (Fig. 28). At first this almost universal splitting of the calyx, together with the presence of the chinks in the floor of the head, were taken as indicating a regular mode of seed distribution; but further examination showed it to be only a secondary mode at most; the primary

one is through the hairy throat. The force which raises the seeds from the bottom of the calyx is centrifugal, created by rapid spring-like movements of the stiff flower stalks; and on any windy day if numerous heads be examined, seeds may be found wedged among the stiff hairs of the calyx throat, unable to escape. These bristles are capable of rapid hygroscopic movement (Figs. 29-30).

While searching for examples of seed distribution, attention was called for the first time to the richly endowed disbursive powers of *Polygonum Virginianum* (Figs. 38–43). The two long reflexed styles of this plant, which are notably persistent, are extremely elastic when dry and at the same time arranged in such relations to each other, that they form an inverted wedge-shaped space capable of holding, when once inserted, the hair of any passing animal. If slight pressure is brought to bear upon the under side of these strong, persistent styles, the seed suddenly separates from its pedicel and flies to the distance of several feet from the plant. The seed in its passage through the air follows a continuous path without revolutions on its own axis.

DESCRIPTION OF FIGURES. (Plate CXVI.)

No. 1. *Campanula Americana.* Dry.
No. 2. The same thirteen minutes after immersion in water.
No. 3. *Veronica Virginica.* Dry.
No. 4. The same moistened.
No. 5. View from above of dry capsule.
No. 6. *Syringa vulgaris.* Dry.
No. 7. The same moistened.
No. 8. Side view, showing seeds *a*.
No. 9. *Steironema longifolium.* Dry.
No. 10. The same fifteen minutes after being placed in water.
No. 11. Green pod of *Claytonia Virginica*, seen from above.
No. 12. The same dry, after seeds have been thrown.
No. 13. The pod ready for dispersion of seeds: *a*, *b*, and *c*, seeds first, second, and third, in order of expulsion.
No. 14. Side view of pod after expulsion of the seeds.
No. 15. Side view of seed.
No. 16. *Hybiscus Syriacus.* Dry.
No. 17. Same in water fifteen minutes.
No. 18. *Hypericum Ascyron.* Dry.
No. 19. Same in water five minutes.
No. 20. *Cassia Chamæcrista.* Dry.
No. 21. Same immersed in water six minutes.

No. 22. Spikelet of *Hordeum jubatum*. Dry.
No. 23. Same in water three hours.
No. 24. *Solidago Canadensis*. Dry.
No. 25. Same immersed in water five minutes.
No. 26. Calyx of *Brunella vulgaris*. Dry.
No. 27. The same wet.
No. 28. Calyx of *Monarda fistulosa*, showing slits near the base.
No. 29. The same seen from above when dry.
No. 30. The same when wet.
No. 31. Achenia of *Cnicus altissimus*. Dry.
No. 32. The same wet.
No. 33. *Dictamnus Fraxinella*. Dry.
No. 34. The same immersed in water fifteen minutes.
No. 35. *Viola palmata* var. *cucullata*. Very wet.
No. 36. Same drying out.
No. 37. Same very dry.
No. 38. Portion of spike of *Polygonum Virginianum*, showing fruit.
No. 39. Same, showing arrangement of fruit enlarged.
Ny. 40. End view of fruit with persistent styles.
No. 41. Styles enlarged.
No. 42. Side view of pedicel, showing peculiar modes of attachment.
No. 43. Front view of the same.

Notes from Pennsylvania.

At my solicitation, J. K. Small and A. A. Heller, students of Franklin and Marshall College, visited Lycoming County, Penn., on the 20th of last August, in order to search for *Asplenium fontanum*, L. along Lycoming Creek, where it was found by McMinn. The cliffs on the east side of the stream were explored for a distance of twelve miles, but without success. Those on the west side, not easily accessible on account of high water, were left for future examination.

From this point the young botanists proceeded to Luzerne County and spent the two following days about one of those little lakes or ponds, so common on the great mountain-plateau of N. E. Pennsylvania. Here they obtained a fine prize in *Aster concinnus*, Willd., and, had they then been aware of the fact, would have brought away a full supply. Mr. McMinn (not "Minn," as printed in the Synoptical Flora) was a civil engineer, who resided many years in Williamsport and collected the rarer plants of the region round about that city, as well as of the counties further west. He was the first, after the time of Muhlenberg, to meet with this *Aster* in its native haunts, and

from him specimens reached H. Cosson of Paris, one of which came into the hands of Dr. Gray and is now at Cambridge. Later, it was found by Prof. Harvey in Arkansas. And, last of all, I had the good fortune to discover it not long since amongst unnamed species in the herbarium of Mr. E. A. Rau of Bethlehem, Pa. The specimens, five in number, were brought by his cousin, Mr. Robert Rau, from Moraviantown, Canada, eighty miles west of Niagara Falls.

Of the other plants gathered at the little lake, the most noteworthy are *Juncus pelocarpus* (known before as existing in Pennsylvania in a single bog of Monroe County), *Eleocharis olivacea* (new to the State) and, strangest of all, an *Artemisia* which closely resembles the European *A. Pontica*, but cannot be determined positively for lack of flowers. A foot or less in height, it covers a space of several rods square on the bank of the lake shore, in the heart of the wilderness, remote from fields, farm-houses and roads of any kind. How it was ever carried to such an out-of-the-way spot is a problem very hard to solve. The same thing, in the same condition, was collected by me, some years ago, on an embankment of the Belvidere and Delaware Railroad below Frenchtown, N. J., but its occurrence there can easily be accounted for.

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Botanical Notes.

Is Solidago serotina, Ait. var. gigantea, A. Gray, a Hybrid? During the autumn, I collected seeds of *Solidago serotina*, Ait. var. *gigantea*, A. Gray, near Ithaca. In examining them with a view to selecting some of them to plant, they were all found to be infertile. The achenia were, to all external appearances, perfectly developed, but no embryo was found in any of them. So far as it goes this may be evidence of this variety being a cross between two other species, although it by no means proves it to be so. The plant is intermediate between *S. serotina*, Ait. and *S. Canadensis*, L. I have carefully examined specimens of both species and have failed to detect any character in the variety which may not be found in one of the species. Moreover, both of the species grow with the variety. To prove by direct crossing that one species crossed with the other will produce the variety, would be the only way in which to prove absolutely

the supposition. Seeds of the two species collected at the same time and the same place, were fertile; the plants of the variety seemed to be healthy and strong.

If further observation should prove that the seeds of this plant are always infertile, this, taken with the place of growth, and the intermediate character, would be evidence enough, at least to suggest that *S. serotina*, Ait. var. *gigantea*, A. Gray is *S. serotina*, Ait. × *S. Canadensis*, L.

Cornell University. W. W. ROWLEE.

Aristolochia clematitis. I have recently received some specimens of this plant, collected near the centre of this county, with the information that it threatens to become a pest. Gray's Manual, 6th Edition, gives but one locality, that near Ithaca, N. Y.

It would be interesting to know, if attainable, the history of the introduction of this plant in each locality, and also the date when first noticed.

Melia Azederach. A specimen of this tree which had been grown as a pot-plant for about four years, was set in the open ground in the spring of 1888, and has since been thriving without any protection other than that of situation, producing both flowers and fruit the past two seasons. It stands near the southwest corner of the house, and is sheltered from all northerly winds. The locality is near Chester, or a little south of latitude 40°.

Of course our last two winters have been very mild, but has it ever been known to survive the winter so far north in any other locality?

Delaware Co., Pa. WILLIAM TRIMBLE.

Flaveria Contrayerba, Pers. This plant was collected by Mr. B. F. Bush near Courtney, Mo., far north of its recorded range. In all its gross aspect it agrees fully with the herbarium specimens under this name. Yet, the heads are five-to-eight-flowered, not "three-to-five-flowered;" and the ligule *does* slightly exceed the disk flowers. If the characterization of this species in the Synoptical Flora is absolute, then this must be a different species. But since the outward appearance of the plant from Missouri agrees so fully with *Flaveria Contrayerba*, and with

no other species, I have after long hesitation decided to put it here. This in view of the well-known fact that the number of florets in the Compositæ frequently varies. The Syn. Flora puts *F. Contrayerba* under species with three-to-five-flowered heads, while the Missouri plant has them five-to-eight-flowered. Further, the typical plant is said to have "ligule not exceeding disk or wanting;" in this plant the ligule does exceed the disk flower, as stated. It would certainly seem possible, and probable, that this character might be subject to the same variation as the number of florets. Rather than make it a new species, therefore, or even a new variety, I have assumed that the assigned distinguishing characters must be subject to variation, and that the Missouri plant is still this species. JOHN M. HOLZINGER.

U. S. Dept. Agric.

Specimens of Haloragеæ desired. The subscriber being engaged in a special study of the North American Haloragеæ, wishes to examine plants of the family from all parts of the country, and will be greatly obliged to any of his correspondents or other botanists who will supply him with specimens.

Columbia College, Feb. 24. THOMAS MORONG.

Phlox bifida, again. Since the appearance in the November number of the BULLETIN of my note entitled, "Geographical Distribution of *Phlox bifida*," I have received specimens and communications which go to show than it has a more extended range than has been assigned to it. I have received specimens from J. J. Davis, of Racine, Wis., who informs me that they were collected on the sandy banks of Cedar River, at Vinton, Ia., where it grew abundantly. Prof. Beal, of Agricultural College, Mich., has sent me specimens collected by C. F. Wheeler the past season, on the shore of Klinger Lake, St. Joseph Co., Mich. As yet I have received no confirmation of a Missouri habitat. I would be glad to hear from any botanist who knows of its existence in that State

FRANK E. MCDONALD.

Review of Foreign Literature.

Leitfaden der Botanischen Mikroskopie. Wilhelm Behrens. Braunschweig Harald Bruhn, Oct. 1890.

It may be desirable to call the attention of the readers of the

BULLETIN to a new book in technique for beginners in microscopic botany, by W. Behrens, which has recently been issued in Germany. The first eighty-three pages discuss, in a very readable manner, and with excellent illustrations, the simple and compound microscopes, the polariscope, spectroscope, methods of measuring, of drawing and photographing microscopic objects.

In order to present these subjects intelligently to the reader, the book is introduced by a discussion of the phenomena of light. The lenses and objectives are well illustrated, both in piece and in section, so that any one can easily understand their workings.

This is equally true of all the accessory apparatus. The remaining one hundred and twenty-five pages discuss, fully enough for all beginners, the better methods of preparing, hardening, staining, and preserving materials for microscopical examination.

Something of the care with which the minor details are looked after may be judged from the fact that over ten pages are devoted to careful directions concerning the selection and sharpening of knives, and methods of holding the same in free-hand cutting.

Directions are given for collecting, cultivating when necessary, hardening, fixing, bleaching, and macerating different kinds of tissues and material for the microscope. Also full instructions for making permanent mounts of various kinds.

Methods of embedding in glycerine–jelly, gum-arabic, celloiden, paraffin, and transparent soap, are all fully and explicitly given. Even some of the foreign bodies which are most likely to find their way into microscopic preparations, are discussed and illustrated.

The merits of this book are, first, that it gives the student directions about many minutiæ not generally spoken of in such books, but on points always sure to trouble the learner. To illustrate: on the use of the fine adjustment, which even advanced students sometimes neglect to their great disadvantage; or on the manipulation of the light for different effects, often not understood by even those who are far advanced in work. The instruction on this point, i. e. the positions of the mirror, the handling of the diaphrams, and the parts of the Abé condenser,

is of greatest importance to any student of microscopy. The directions for free-hand cutting will prove valuable for such as have not had the advantage of good instructors.

Second, that in the directions for preparing and preserving material, the author has given a judicious selection of the best methods and solutions, omitting a great mass of formulæ and recipes, which only confuse the beginner. Such methods, formulæ, and solutions as have been given, have all been tried by the author and found to work well.

The book would make a valuable manual for our young students of botany were it translated just as it stands. It would give them in the hand the most recent methods for the manipulation of microscopic objects; which knowledge now must be picked up wherever it can be found.

W. P. WILSON.

Biographical Index to British and Irish Botanists. James Britten and G. S. Boulger. (Journ. Bot. 1888–1890).

This very useful index, published in the numbers of the Journal for the last three years, is now about completed. It consists of a list of all persons residing in the British Islands who have been at all prominent in the science, including collectors and patrons of Botany. The date and place of birth and death, the place of burial, chief titles, dates of election to the Linnæan or Royal Societies, with references to sources for further information, as the following sample will indicate.

SHUTTLEWORTH, ROBERT JAMES (1810-1874): b. Dawlish, Devon, Feb. 1810; d. Hyères, 19th April, 1874. Captain, 1st Regiment, Duke of Lancaster's Own, 1833. F.L.S., 1856. Orig. memb. B.S.Ed. Conchologist and critical botanist. Resided many years at Berne. 'Excursion in the Valais,' Mag. Zool. Bot. 1838. Had large herbarium, now in Herb. Brit. Mus. (see Journ. Bot. 1878, 179). Jacks. 158; R.S.C. v. 681; Trans. Bot. Soc. Ed. xii. 203; Bull. Soc. Bot. France, xxx. cxxxi.; Whittle, Hist. Preston, ii. 235; Journ. de Conch. xxii. 92. *Shuttleworthia* Meisn.=*Verbena*.

The authors now propose to issue the work as a reprint, and ask for subscriptions at four shillings per copy, bound in cloth, the

list being brought down to January, 1891, and considerable information added to that already printed in the Journal. While the list is of not quite the importance to American botanists that it is to English there is so much matter of direct application to our own Botany that it really ought to be in the hands of all. We are so much interested in the success of this project that we will receive subscriptions to the work at $1 per copy, payments to be made when the book is received. N. L. B.

Index to Recent Literature relating to American Botany.

Actinella (*Hymenoxis*) *Texana, n. sp.* John M. Coulter and J. N. Rose. (Bot. Gaz. xvi. 27, 28).

Algæ and Mosses. The Geological Work of. W. H. Weed. (Am. Geol. vii, 48, 55).

This is in the nature of an abstract of the monograph upon the subject prepared by the author and published in the Ninth Ann. Rept. U. S. Geol. Surv., previously reviewed in the BULLETIN.

Apical Growth in the Roots of Osmunda and Botrychium, —Notes on the. D. H. Campbell. (Bot. Gaz. xvi. 37-43, Pl. v).

Asplenium Filix-fœmina as a Tree Fern. Katharine Brandegee. (Zoe, i. 293-295).

Catalogue of the Anthophyta and Pteridophyta of Ames, Iowa. A. S. Hitchcock. (Trans. St. Louis Acad. Sci. v. 477-532; reprinted "Contributions from the Shaw School of Botany," No. 7).

This is one of the most carefully prepared and valuable local floras ever published, giving the results of the author's studies in the vicinity of Ames during the past seven years. Localities for the rarer species are given in detail. The principle of using the earliest specific name has been closely adhered to, the original author being cited in parenthesis. Many critical and very useful notes on nomenclature and determination of species are given. Several old names are here first taken up, as follows: *Anemone patens*, L. var. *hirsutissima* (Pursh), for var. *Nuttalliana*, A. Gray; *Anemone Hepatica*, L. var *acuta* (Pursh), for *Hepatica acutiloba*, DC.; *Viola palmata*, L. var. *obliqua* (Hill), for var.

cucullata, A. Gray; *Kuhnia eupatorioides*, L. var. *glutinosa* (Ell.), for var. *corymbulosa*, Torr. & Gray; *Dysodia papposa* (Vent.), for *D. chrysanthemoides*, Lag.; *Lactuca spicata* (Lam.), for *L. leucophæa*, A. Gray; *Steironema quadriflorum* (Sims), for *S. longifolium*, A. Gray; *Acerates Floridana* (Lam.), for A. *longifolia*, Ell.; *Gentiana quinquefolia*, L. var. *occidentalis*, for *G. quinqueflora*, var. *occidentalis*, A. Gray; (there is a misprint in the spelling of the specific name of the synonym); *Stachys aspera*, Michx, var. *tenuiflora* (Willd.), for var. *glabra*, A. Gray; *Carex trichocarpa*, Muhl. var. *læviconica* (Dewey), for var. *Deweyi*, Bailey; *Diarrhena diandra* (Michx.), for *D. Americana*, Beauv. *Fraxinus viridis*, Michx. f., var. *pubescens* is described as new. There has been little effected in taking up old generic names, but we note that Mr. Hitchcock adopts *Castalia* for *Nymphæa* and *Homalocenchrus* for *Leersia*. The catalogue is a most important contribution to geographical botany, and should stimulate botanists all over the country to produce others of equal merit.

N. L. B.

Catalogue of Canadian Plants.—Part V. Acrogens. John Macoun. (8vo, pp. 249-428, Montreal, 1890).

This part completes the second volume of Prof. Macoun's great Catalogue, containing the Pteridophyta (the Filices and Ophioglossaceæ contributed by Dr. Burgess), included in Nos. 2956-3054. The greater part of the present fascicle is taken up with additions and notes on Parts I-IV. a very considerable number of Flowering Plants being added. Of these *Arabis Columbiana*, Macoun, and *Ruppia lacustris*, Macoun, are described as new; the latter is however antedated by Dr. Watson's name *R. occidentalis*, applied to the same plant. Mr. Macoun describes also two new varieties of *Carex canescens*. Prof. Scribner has studied the Gramineæ, new varieties and species being indicated in the genera *Alopecurus*, *Stipa*, *Agrostis* and *Festuca*. Mr. Arthur Bennett has examined the *Potamogetons*, and several novelties are listed. Part VI. of the Catalogue, including Characeæ, Musci and Hepaticæ is announced for the present year. We congratulate Prof. Macoun on the very successful progress his work. He is contributing more at the present time to our knowledge of North American Botany than any one else, and

through his endeavors the distribution of Canadian Plants is becoming thoroughly worked out. N. L. B.

Catasetum fimbriatum. (Bot. Mag. t. 7158).

Choisya ternata. (Gard. xxxix. 115, illustrated.

A description and representation of this plant as it appears in a Devonshire garden.

Clethra alnifolia, var. *tomentosa.* (Gard. and For. iv. 64, f. 14).

Contributions à la Flore de l'Amérique équatoriale. Em. Drake del Castillo. (Journ. de Bot. iii. 73-77, 237–240).

This is an enumeration of the Ericaceæ aud Campanulaceæ collected by H. Poortmann in 1881-1882 in the Andes of Ecuador and Peru. New species are described in the genera *Macleania, Orthæa, Ceratostemma, Befaria* and *Centropogon.*

Coreopsideæ and Tagetineæ—Studies in. T. S. Brandegee. (Zoe, i. 308-314).

A discussion of species in the genera *Leptosyne, Heterospermum, Bidens, Porophyllum* and *Tagetes,* with descriptions of *Bidens nudata, B. refracta, Tagetes lacera* and *T. scabra* as new, all from Lower California.

Dahlias in Mexico. C. G. Pringle. (Gard. and For. iv. 50, 51).

Notes on *Dahlia pubescens, D. dissecta, D. coccinea and D. variabilis.*

Descriptions of Three New Species of Myxomycetes, with Notes on other Forms in Century XXV. of Ellis and Everhart's North American Fungi. Geo, A. Rex. (Proc. Acad. Nat. Sci. Phil. 1890, Part ii, 192-196).

The three new species described in this contribution are *Physarum tenerum, Trichia subfusca* and *T. erecta.*

Diplacus.—Revision of the Genus. Edward L. Greene. (Pittonia, ii. 141-157).

6 species are recognized. *D. longiflorus,* Nutt., replaces *D. arachnoideus,* Greene, Bull. Cal. Acad. i. 210, and *D. grandiflorus* replaces *D. longiflorus,* Greene, l. c. i, 96. *D. stellatus,* Kell. and *D. latifolius,* Nutt. are referred to *D. glutinosus* (Wendl.), Nutt. as varieties.

Dipladenia illustris, var. glabra. (Bot. Mag. t. 7156).

Euphorbiceæ Collected by T. S. Brandegee, principally in the vicinity of Todos Santos, Baja California, January and February, 1890. C. F. Millspaugh. (Zoe, ii, 346-348).

The following species are described as new: *Euphorbia* (*Anisophyllum*) *biserrata* and *E.* (*Alectrotonum*) *Watsoni.*

Fritillaria recurva. Carl Purdy. (West Am. Sci. vii. 67, figured).

Fungi—New North American. J. B. Ellis and B. M. Everhart. (Proc. Acad. Nat. Sci. Phil. 1890, 219-249).

The following are described as new: *Typhula subfasciculata, Stereum atrorubrum, Hymenochæte rugispora, Asterina rubicola, A. bignoniæ, Chætomium pusillum,* (N. A. F. 2350), *Myriococcum consimile, Calosphæria alnicola, C. microsperma, Cœlosphæria corticata, Diaporthe nivosa, Valsa floriformis, V.* (*Eutypella*) *canodisca, Pseudovalsa stylospora, Thyridoria fraxini, Cryptovalsa sparsa, Diatrype Macounii, D. hochelagæ, Dyatrypella vitis, D. demetrionis, Ceratostomella mali, Ceratostoma juniperinum, C. parasiticum, C. conicum, Rosellinia albolanata, R. glandiformis, R. parasitica, R. Kellermanni, R. Langloisii, Anthostoma Ontariensis, Anthostomella Ludoviciana, Hypoxylon albocinctum, Poronia leporina, Physalospora zeicola, P. conica, P. pandani, Laestadia orientalis, L. apocyni, Sphærella conigena, S. spinicola, S. ciliata, S. angelicæ, S. macluræ, S. polifolia, Didymella Canadensis, D. cornuta, D. andropogonis, D. mali, Venturia parasitica, V. sabalicola, Diaporthe columbiensis, D.* (*Euporthe*) *leucosarca, D. crinigera, D. comptoniæ, D. Americana, D. megalospora, Didymosphæria andropogonis, Melanconis salicina, Valsaria salicina, Leptosphæria macluræ, L. steironematis, L. brunellæ, L. folliculata, Metasphæria rubida, Pleospora diaportheoides, P. hyalospora, Pyrenophora Zabriskieana, Fenestella amorpha, Ophiobolus trichisporus, Melanomma Commonsii, M. tetonensis, M. parasiticum, Wintera tuberculifera, Cucurbitaria Kelseyi, C. fraxini, C. setosa, Teichospora mammoides, T. mycogena, T. umbonata, T. papillosa, T. megastega, T. helenæ, T. Kansensis, Hypocrea pallida, H. melaleuca, Calonectria Dearnessii, Thyronectria chrysogramma, Chilonectria crinigera, Nectria diplocarpa, N. Sambuci, N. athroa, N. mammoidea, N. pithoi-*

des, N. sulphurata, Homostegia Kelseyii, Dothidea Bigeloviae, Plowrightia staphyliana, P. symphoricarpi and *Curreya shepherdiæ.* Under *Valsa glandulosa,* Cke., the authors state that specimens examined by them from several parts of the United States have the ostiola distinctly 4-5 sulcate. They therefore place it in the sub-genus *Eutypella* and take issue with Cooke who has described specimens from one of the same localities as a new species, *Valsa clavulata* [Grevillea, xviii. 86]. A. H.

Fungi—New species of Montana. J. B. Ellis and F. W. Anderson. (Bot. Gaz. xvi. 45-49, Pl. vii and figs. in text).

Lentinus pholiotoides, Phoma ilicina, Coniothyrium ilicinum, Dothiorella Nelumbii, Volutella occidentalis (Pl. vii, f. 1-6), *V. occidentalis,* var. *minor, Sporidesmium sorisporoides, Macrosporium puccinioides,* (Pl. vii, f. 7-11), *Æcidium Liatridis, Æ. Cleomis, Æ. Chrysopsidis, Pestaloziella Andersonii* (Pl. vii, f. 12-14) and *Helotium Montaniense*—the latter figured in the text.

Grasses—New. Geo. Vasey. (Bot. Gaz. xvi. 26-27).

The following new species and varieties are described: *Sporobolus pilosus,* from Kansas, *Bouteloua uniflora,* from Texas, and *Andropogon macrourus,* Michx., var. *pumilus,* also from Texas.

Hyphomycetes.—On certain New or Peculiar North American—I. Roland Thaxter. (Bot. Gaz. xvi. 14-26; Pl. iii. and iv).

The new species described are *Œdocephalum echinulatum, Œ. verticillatum* and *Rhopalomyces strangulatus.* A new genus, *Sigmoideomyces,* is described, with a single species, *S. dispiroides.* A syonopsis of the described species of *Œdocephalum* and *Rhopalomyces* is appended. The plates include the above named species, besides *Rhopalomyces elegans,* Corda, *Œdocephalum glomerulosum.* (Bull) Sacc., and *O. pallidum* (B. & Br.) Cost. A. H.

Juglans Vilmoriniana.—M. L. de Vilmorin, (Gard. & For. iv. 51, 52, f. 11 and 12).

Account and description of a supposed hybrid between *Juglans regia* and *J. nigra.* The tree was planted as a seedling in a garden at Verriers, near Paris, and is now about seventy-five years old. Nothing is known of its origin. The seeds germinate readily, produce plants similar to the parent and these in turn

produce fertile fruit. It is of interest in this connection to recall the description of the "Row Farm Walnut tree," (For. Leaves, ii. 133, 134), which is supposed to be a similar hybrid.

Labiatæ.—A Key to the North American Genera of the. Alfred C. Stokes. (Bot. Gaz. xvi. 49-52).

Les Piperacées de l'Ecuador, de la Nouvelle-Grenade et du Pérou, de la collection de M. Ed André, par M. C. De Candolle (Jour. de Bot. iv. 395-399).

Thirty-four species of *Piper* are enumerated in the collection of M. André, of which six are new, and of the genus *Piperomia* there are 45 species, of which ten are described for the first time. The actual number of Piperaceæ known from Ecuador and New Grenada is 139, 93 belonging to the genus *Piper* and 46 to the genus *Piperomia*.

Loti.—Enumeration of the North American. Edward L. Greene. (Pittonia, ii. 133-150).

After a critical study of the Old World specimens of *Lotus* contained in the eastern herbaria, in connection with a study of the types of most of the American species, Prof. Greene concludes that the plants usually referred to *Hosackia*, Benth. and *Syrmatium*, Vogel, are generically inseparable from the true *Loti*. He enumerates 55 species, three of which are described as new.

Lotus Tree.—Parry's. Albert Kellogg. (West Am. Sci. vii, 63-66, illustrated).

Contains descriptions of *Zizyphus Lotus, Z. vulgaris, Z. jujube, Z. xylopyrus, and Z. Parryi*—the latter figured.

Memoirs of the Torrey Botanical Club, Vol. ii. No. 2. (P. 27-56; 2 plates).

This number of the Memoirs, issued Dec. 23rd, contains an account by Miss Anna Murray Vail of the Spring Flora of Southwestern Virginia, as noted by a party who spent some days in exploring that region in May and June, 1890. The paper is annotated by Dr. Britton, who describes the following plants as new:—

Clematis Addisonii, named in honor of the president of the Club (*C. ovata*, Torr. and Gray, not Pursh), *Pentstemon lævigatus*, var. *canescens*, and *Senecio aureus*, var. *angustifolius*; he

maintains *Ilex montana*, T. and G. (1848) as the correct name for the shrub usually called *I. monticola*, A. Gray (1856), and points out that *Arenaria stricta*, Michx., is the name which should be applied to *A. Michauxii*, Hook. f.; he maintains *Oxalis stricta*, L. as distinct from *O. corniculata*, and raises *Zizia aurea*, var. *Bebbii*, Coult. and Rose, to specific rank. Among the other most interesting plants noted are *Crepis pulchra*, L., a European Composite seen in large quantities along the railroad at Culpepper, *Veronica Anagallis* at Roanoke, not previously reported from so far south, *Anemone trifolia*, L., *Rhododendron canescens* (Michx.), Porter, and the introduced form of *Ranunculus sceleratus*, L. Miss Vail gives a complete enumeration of the flowering plants and ferns collected, taking up some old names, *Hepatica acutiloba*, DC. becoming *Anemone acuta* (Pursh) and *Trautvetteria palmata*, F. and M., becoming *T. Caroliniensis* (Walt.)

The Memoir also contains a paper by Mr. Arthur Hollick on the Autumn Flora of Southeastern Virginia, a record of a trip made in September. Among the more important finds were *Lespedeza striata*, *Andromeda nitida*, *Eleocharis ochreata*, and *Panicum gibbum*, all apparently here first reported from the state.

New or Noteworthy Species. Edward L. Greene. (Pittonia, ii. 158).

Sagittaria Sanfordi and *Lathyrus Jepsoni*, from near Stockton, Cal., are described as new.

Nicotiana colossa. (Gard. Chron. ix. 84, f. 25).

Nolina—A New. T. S. Brandegee. (Zoe, i. 305, 306).

Notes on North American Trees. XXIII. C. S. Sargent. (Gard. and For. iv. 75, 76).

Critical notes upon *Rhamnus Caroliniana*, *R. Purshiana*, *R. rubra*, *R. Californica*, *R.occidentalis*, *and R. tomentella* are contributed.

Notholæna Nealleyi, Seaton. Observations on the New Texas Fern as Described in "Contributions from the U. S. Hebarium," ii. p. 61, no 894, June, 1890, and a Mexican Fern collected by C.

G. Pringle near Guadalajara in 1888. Geo. E. Davenport. (Bot. Gaz. xvi. 53, 54).

The author makes use of the parallel column and concludes from the comparison of descriptions that *Notholæna Nealleyi*, Seaton, is not specifically distinct from *Notholæna* sp ? Pringle No. 1864. The conclusion is that the latter should rank as a variety of the former and be known as *N. Nealleyi*, Seaton, var. *Mexicana*.

Quebracho, Part I. H. H. Rusby. (Reprint from Bull. Pharm. Jan. 1891, illustrated).

An illustrated account of *Aspidosperma Quebrachoblanco* and its confusion with *A. Colorado*.

Rafinesque—Some Genera of. Edward L. Greene. (Pittonia, ii. 120-133).

Professor Greene points out that *Lepargyræa*, Raf. antedates *Shepherdia*, Nutt. by about a year, and transfers our three described species to that genus, that *Ioxylon*, Raf. has about equal precedence over *Maclura*, Nutt. the proper name for the Osage Orange being *I. pomiferum*, Raf. and that *Bolelia*, Raf. should replace *Downingia*, Torr.; he takes up *Micrampelis*, Raf. for *Echinocystis*, Torr. and Gray, and *Megarrhiza*, Torr., following the point made by Mr. Jas. Britten in Journ. Bot. xxvi. 261 (1888), and recognizes *Ptiloria*, Raf. (1832) as prior to *Stephanomeria*, Nutt. (1841), consisting of 16 species, two of which are here first described.

Ranunculaceæ aus dem Westlichen Nord Amerika, gesammelt in Auftrage Dr. Dieck's-Zoschen. Bestimmt von J. Freyn. (Deutsche Bot. Monats. viii. 73-79).

This is an enumeration of the Ranunculaceæ collected in British Columbia, Montana and Oregon, by the expedition sent by Dr. Dieck in 1887 and 1888 under the charge of Dr. Röll. The following species are given: *Clematis ligusticifolia*, T. and G.; *C. Pseudoatragene*, O. Kuntze, var. *normalis*, O. Kuntze (*C. verticillaris*, DC.); *Thalictrum occidentale*, A. Gray; *T. Cornuti*, Lawson, not L., which is apparently what we now know as *T. polygamum*, Muhl.; *Pulsatilla occidentalis*, Freyn (*Anemone occidentalis*, S. Wats; *Anemone parviflora*, Michx; *Anemone*

cyanea, Freyn, sp. nov., which is pretty clearly *A. Grayi*, Kellogg and Behr; *Anemone multifida*, Poir., var. *globosa*, T. and G.; *Trautvetteria grandis*, Nutt.; *Ranunculus longirostris*, Godron, (*R. circinatus*, A. Gray); *R. Grayanus*, Freyn. n. subsp. (*R. aquatilis heterophyllus*, T. and G.); *R. radicans*, C. A. Meyer (*R. multifidus*, var., *repens*, S. Wats; *R. natans*, A. Gray, not C. A. Meyer); *R. Cymbalaria*, Pursh; *R. reptans*, L., var., *strigulosus*, Freyn; *R. Eschscholtzii*, Schlecht.; *Trollius Americanus*, Muhl. (*T. laxus*, Salisb. must replace this, as Muhlenberg's name is without description); *Delphinium variegatum*, T. and G. and *D. bicolor*, Nutt. N. L. B.

Rose Bay—Southern Stations of. T. S. Brandegee. (Zoe, i. 315.

Note on the occurrence of *Rhododendron Californicum* in Santa Cruz Co., Cal.

Sarcodes sanguinea. Thos. Meehan. (Bot. Gaz. xvi. 54).

In this note the author contends that this plant is not a root-parasite but a saprophyte.

Tricuspidaria dependens. (Bot. Mag., T. 7160).

Two New Plants from the Cascade Mountains. B. L. Robinson. (Bot. Gaz., xxi. 43-45. Pl. vi).

Luina Piperi and *Silene Suksdorfii* are described and figured as new, collected by Mr. C. V. Piper. The *Silene* had previously been found by Mr. Suksdorf.

Undescribed Plants from Guatemala. VIII. John Donnell Smith. (Bot. Gaz., xvi. 1-14, Pl. i. and ii).

Description of the following new species and varieties are given by Capt. Smith, M. A. Cogniaux, Dr. Masters and others. *Bocconia vulcanica, Chorisia soluta, Myrodia Guatemalteca, Heteropteris retusa, Rubus occidentalis* L., var. *grandiflora, Potentilla Donnell-Smithii, Agrimonia parviflora*, Ait., var. *macrocarpa, Tibouchina Bourgaeana, Monochaetum diffusum, Conostegia hirtella, Miconia Guatemalensis, M. Tuerckheimii, Clidemia laxiflora*, Walp., var. *longipetiolata, C. Donnell-Smithii, Jussiæa Peruviana*, L., var. *glaberrima, J. pilosa*, H.B.K., var. *robustior, Passiflora clypeophylla, P. allantophylla, P. transversa, P. ornithoura, P. dicthophylla, Melothria Donnell-Smithii, M.*

Donnell-Smithii vars. *hirtella* and *rotundifolia*, *Anguria oblongifolia*, *A. diversifolia*, *Gurania Donnell-Smithii*, *Sicyos longisepalus*, *Cephaelis glomerulata*, (Pl. i.) *Lobelia laxiflora*, H.B.K., var. *insignis*, *Macleania cordata*, Lem., var. *linearifolia*, *Arctostaphylos pungens*, H.B.K., var. *craterícola*, *Daphnopsis Tuerckheimiana*, *Myriocarpa longipes*, Liebm., var. *Yzabalensis* and *Triuris brevistylis*. *Solanum olivæforme*, previously described, is figured on Pl. ii. There is also a note to the effect that the plant described as *Nephrodium duale*. (Bot. Gaz. xv. 29) should be referred to *Aspidium ascendens*, or better designated as *Nephrodium ascendens*.

Viburnum molle. C. S. S. (Gard and For. iv, 29, p. 8.)

Viola hastata. (Gard. and For. iv. 76, p. 16).

Viola ocellata. (Gard. and For. iv. 51, p. 13).

Woodwardia radicans. W. H. Gower. (Gard. xxxix. 127, illustrated).

Proceedings of the Club.

Wednesday Evening, Jan. 28.

Dr. Thos. Morong in the Chair and 28 persons present.

Mrs. E. Dwight Kendall, Miss Sabin G. Ayres and Mr. J. K. Haywood were elected active members.

Dr. Northrop read the announced paper of the evening; "Notes on the Flora of the Bahamas," illustrated by specimens and lantern views.

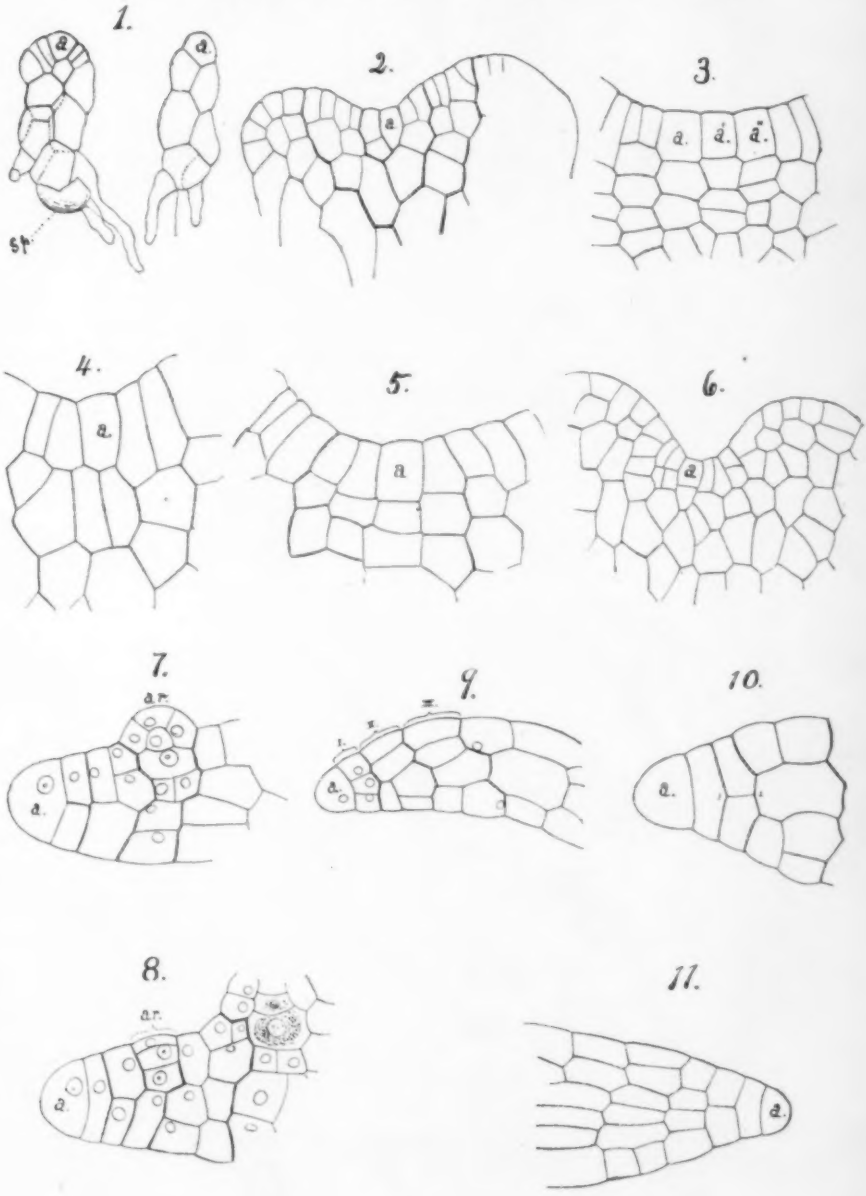
Tuesday Evening, Feb. 11.

The President in the Chair and 13 persons present.

Miss Helen Lauterbach was elected an active member.

Prof. Byron D. Halsted read the announced paper on "Root Decays of the Sweet Potato," illustrated by diagrams. He described the several fungi which attack the roots, causing the several kinds of decay. (See Bulletin New Jersey Agric. Exper. Station No., 76).

Dr. Britton exhibited a bramble collected by Dr. C. F. Millspaugh on the mountains of West Virginia, peculiar in its entirely unarmed stem and glabrous, acuminate leaflets, for which he proposed the name *Rubus Millspaughii*.



D.H. Campbell - del.

D. H. Campbell:—Apical Growth of Fern Prothallia.

INFLUENCE OF MOISTURE UPON DEHISCENT FRUITS.

B. D. Halsted and D. G. Fairchild.